भारतीय मानक
Indian Standard

IS 9436 : 2018

छोटी यात्री गाड़ियों, क्वाड्रीसाइकल्स एवं मिनी भार वाहकों के पहियों की कार्यकारी अपेक्षाएँ एवं परीक्षण पद्धतियाँ

(पहला पुनरीक्षण)

Performance Requirements and Methods of Test for Wheels for Passenger Cars, Quadricycles and Mini Goods Carriers

(First Revision)

ICS 43.040.50;43.080.01;43.100

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Automotive Tyres, Tubes and Rims Sectional Committee, TED 7

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Tyres, Tubes and Rims Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in1980. This revision has been undertaken to align this standard with international practices. This standard is in agreement with the ISO 3006 : 2005 ‘Road vehicles — Passenger car wheels — Test methods’, issued by the International Organization for Standardization. It also includes the performance requirements apart from test methods. In this revision the aluminium wheels have also been included.

In formulation of this standard, assistance has also been derived from SAEJ328a ‘Wheels — Passenger cars— Performance requirements and test methods’, issued by the Society of Automotive Engineers (Inc), USA and ISO 3006-1976 ‘Road vehicles – Passenger car wheels — Test methods’.

This standard does not lay down the profile sand other general requirements. Reference may be made to the following standards for these requirements:

IS No.	*Title*
10694	Automotive vehicles — Rims — General requirements
(Part 1) : 2009	Nomenclature, designation, marking and measurement (*second* r*evision*)
(Part 2) : 2009	Passenger car (*second revision*)

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded of fin accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PERFORMANCE REQUIREMENTS AND METHODS OF TEST FOR WHEELS FOR PASSENGER CARS, QUADRICYCLES AND MINI GOODS CARRIERS

(First Revision)

1 SCOPE

This standard specifies laboratory test methods and performance requirements including certain essential fatigue strength characteristics of wheels intended for passenger cars, quadricycles, mini goods carriers and vehicles of categories M1 as defined in IS 14272.

The test methods are:

a) Dynamic cornering fatigue test; and
b) Dynamic radial fatigue test.

1.1 Test termination for the tests on wheels has also been specified.

2 REFERENCE

The following standard contains provisions, which through reference in this text constitutes provision of the standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard is encouraged to investigate the possibility of applying the most recent edition of the standard indicated below

IS No.	*Title*
14272 : 2011	Automotive vehicles — Types terminology

3 TERMS AND DEFINITIONS

For the purpose of this standard the following terms and definitions shall apply.

3.1 Wheel Rim — The wheel rim is the outer edge of a wheel, holding the tyre. It makes up the outer circular design of the wheel on which the inside edge of the tyre is mounted on vehicles such as automobiles to agreements based on this standard.

3.2 Static Loaded Radius — The measurement in metres from the wheel axle centerline to the ground when the tyre is properly inflated corresponding to the rated load.

3.3 Inset and Outset

3.3.1 *Inset* — The inset is the distance between the mounting face of the disc and the rim centerline. This distance is called inset when the mounting face is inside of the rim centerline.

3.3.2 *Outset* — The in set is the distance between the mounting face of the disc and the rim centerline. This distance is called out set when the mounting face is outside of the rim centerline

4 GENERAL

Only fully processed new wheels/rims which are representative of wheels/rims in tended for the vehicle shall be used for the tests. No wheel/rim shall be used for more than one test.

5 TESTS

5.1 Dynamic Cornering Fatigue Test

5.1.1 *Equipment*

The test machine shall have a driven rotatable device where by either the wheel rotates under the influence of a stationary bending moment or the wheel is stationary and is subject to a rotating bending moment (*see* Fig. 1).

5.1.2 *Procedure*

5.1.2.1 *Preparation*

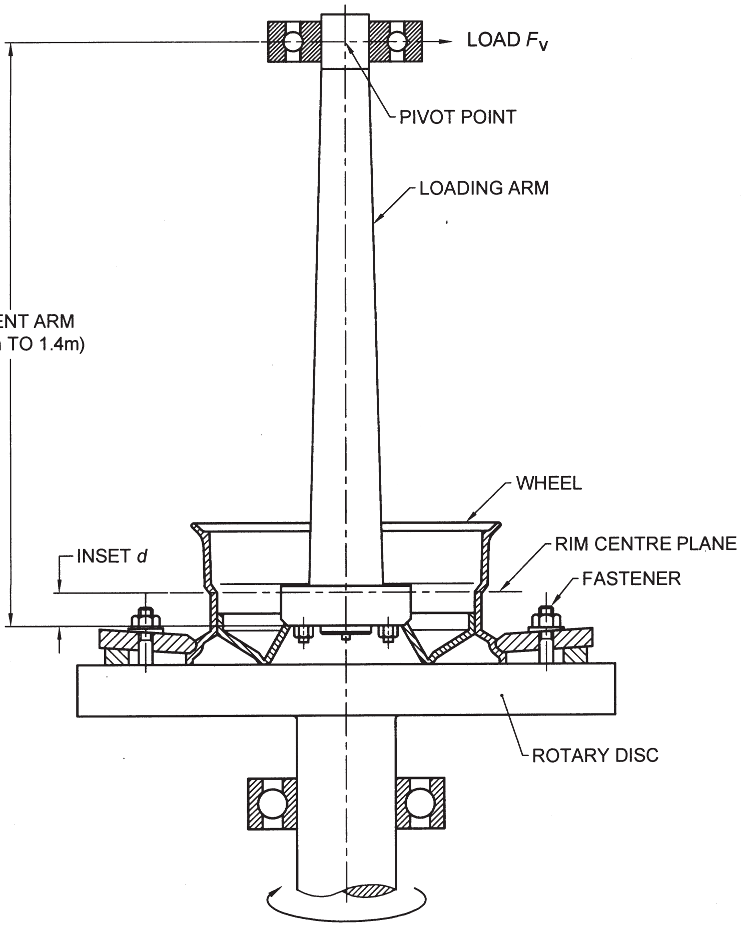
Clamp the rim of the wheel securely to the test machine with the help of suitable adators/jigs.The adaptor face of the test machine shall have equivalent mounting systems to those used on the vehicle. The mating surface of the test adaptor and wheel shall be free of excessive scoring and deformation, and excessive build-up of paint, dirt or foreign matter.

Attach the load arm and adaptor assembly to the mounting surface of the wheel using studs or bolts, and nuts which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those used on the vehicle. Tighten these wheel nuts or bolts at the beginning of the test to the vehicle or wheel manufacturer specified torque values.

Wheel bolts or nuts may be retorqued during the test.

5.1.2.2 *Bending moment application*

Toim part abending moment to the wheel, apply a force



Key

1. Pivot point	2. Loding arm	3. Wheel
4. Fastener	5. Rim centre plane	6. Rotary disc
a) Load, Fv	b) Moment arm, l (0.5 m to 1.4 m).	C) Inset, d.

FIG. 1 EXAMPLE OF DYNAMIC CORNERING FATIGUE TEST FIXTURE

parallel to the plane of the wheel mounting surface at a specified distance l (moment arm) of 0.5 m to 1.4 m, as shown in Fig.1.

Maintain the bending moment within ± 2.5percent of the calculated value.

5.1.3 *Bending Moment Determination*

Determine the bending moment M (force × moment arm) is given in newton metres, by the formula:

$$M = (\mu . R + d)\, F_v \times S$$

where

μ = assumed coefficient of friction developed between tyre and road (*see* Table 2);

R = static loaded radius, in metres of the largest tyre to be used on the wheel as specified by the vehicle or wheel manufacturer;

d = inset or outset (positive for inset; negative for outset), of the wheel, in metres;

F_v = maximum vertical static load on the wheel or the wheel load rating in Newtons, as specified by the vehicle or wheel manufacturer; and

S = accelerated test factor (*see* Table 2).

NOTE — For values of μ and S, *see* Annex A.

5.1.4 *Minimum No. of Performance Cycles to be Completed*

The wheel rim shall with stand a minimum no. of cycles with out failure as specified in Tables 2 and 4, prior to test termination.

5.1.5 *Test Termination*

The test shall be terminated in either of the following two circumstances:

a) In ability of the wheel to sustain the calculated test bending moment; and

b) Propagation of crack or cracks existing prior to test or new visible stress-caused crack penetrating through a section of the wheel.

5.2 Dynamic Radial Fatigue Test

5.2.1 *Equipment*

The test machine shall be equipped with a means of imparting constantradial load as the wheel rotates. There are many means of imparting radial loads: the suggested equipment in corporates a driven rotatable drum which presents a smooth surface wider than the loaded test tyre section width. The recommended minimum external diameter of the drum is 1 700 mm ± 1 percent.

The test wheel (single application) and tyre fixture shall provide loading normal to the surface of the external surface and inline radially with the centre of the test wheel and drum. The axes of the drum and test wheel shall be parallel (*see* Fig. 2).

The mating surfaces of the test adaptor and wheel shall be free of excessive scoring and deformation, and excessive build-up of paint, dirt or foreign matter.

5.2.2 *Procedure*

Tyres selected for this test shall meet the load rating *F*v of the wheel or be representative of the maximum load capacity, size and type specified by the vehicle or wheel manufacturer, whichever is greater.

The test adaptor shall be representative of production hubs using studs or bolts and nuts which are in good condition, lubricated or non-lubricated in accordance with the intended vehicle application (as specified by the vehicle manufacturer), and are representative of those specified for the wheel.

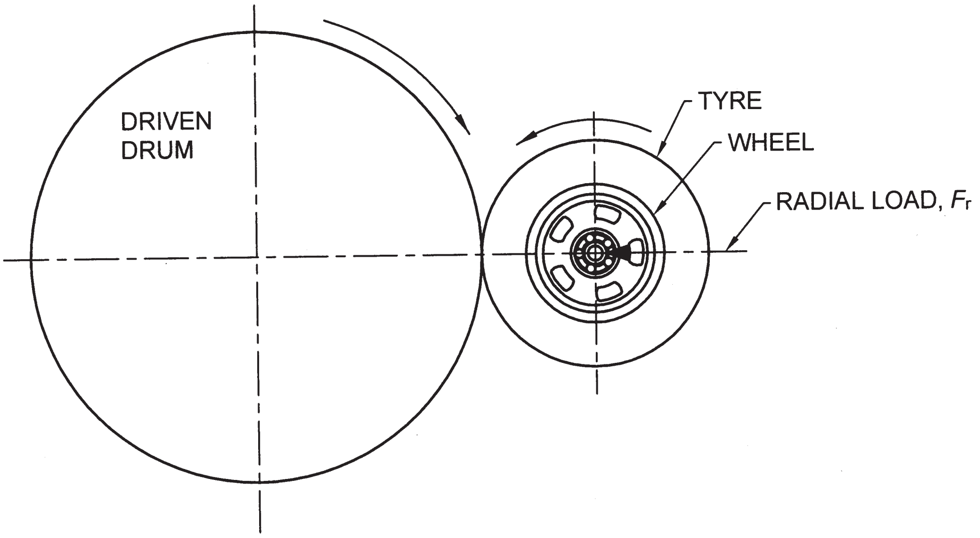
The cold inflation pressure of the test tyre shall be in accordance with the values given in Table 1.

Table 1
(*Clause* 5.2.2)

Sl No. (1)	**Service Pressure** kPa (2)	**Test Pressure** kPa (3)
i)	Up to 160	280
ii)	161 - 280	450
iii)	281 - 450	550
iv)	> 450	As specified by wheel or vehicle manufacturer

NOTE — 100 kPa = 1 bar.

There will be an increase in pressure during the test. This increase is normal and no adjustment is necessary. The loading system shall maintain the specified load within ± 2.5 percent of the calculated values.



Key

1. Driven drum
2. Tyre
3. Wheel

a) Radial load, F_t

FIG. 2 TYPICAL TEST SET UP OF DYNAMIC RADIAL FATIGUE TEST

5.2.3 *Radial Load Determination*

Determine the radial load F_r in Newton, from the formula:

where

F_r = $F_v \times K$

F_v = maximum vertical static load on the wheel or the wheel load rating, in newton, as specified by the vehicle or wheel manufacturer; and

K = accelerated test load factor (*see* Table 3).

NOTE — For values of K, *see* Annex A.

5.2.4 *Minimum No. of Cycles to be Completed*

The wheel rim shall with stand a minimum number of cycles with out failure as specified in Tables 3 and 5, prior to test termination.

5.2.5 *Test Termination*

The test shall be terminated in either of the following two circumstances:

a) In ability of wheel to sustain the load or tyre pressure; and
b) Propagation of a crack or cracks existing prior to test or new visible stress-caused cracks penetrating through a section of the wheel.

6 CRITERIA FOR TYPE APPROVAL

6.1 Type Approval Procedure

6.1.1 Application for type approval to be submitted by the wheel rim manufacturer or vehicle manufacturer.

6.1.2 The application for type approval shall contain at least the technical information as specified in Annex B.

6.1.3 Every functional modification in technical specification declared in accordance with **6.1.2** shall be intimated to the test agency. The test agency may then consider, whether,

a) Wheel rim with modification complies with specified requirement; or
b) Any further verification/test(s) is (are) required.

For considering whether any further verification/test (s) is (are) required or not (Criteria for Extension of Type Approval) specified at Annex C shall be used.

7 CONFORMITY OF PRODUCTION (COP) TESTS

7.1 Dynamic Cornering Fatigue Test

7.1.1 The frequency of COP tests shall be in accordance with AIS : 037-2005 (amendment no. 3, Annex B, Sr. No.11).

ANNEX A

(*Clause* 5.1)

TEST FACTORS AND MINIMUM NUMBER OF TEST CYCLES

A-1 TEST FACTORS AND MINIMUM NUMBER OF PERFORMANCE CYCLE (*See* Tables 2 to 5)

Table 2 Test Factors and Minimum Cycle for Requirements for Wheels in Normal Highway Service — Dynamic Cornering Fatigue

(*Clauses* 5.1.3, 5.1.4 *and* A-1)

Sl No.	Wheel Type (Material)	'S' Front	'S' Rear	'μ'	Minimum No. of Performance Cycles to be Completed
(1)	(2)	(3)	(4)	(5)	(6)
i)	Ferrous all	1.6	1.45		18 000
ii)	Cold formed aluminium 5 000 series	1.8	1.55	0.7	50 000
iii)	Aluminium cast and forged	2.0	1.75		50 000

NOTE — With 3 percent less magnesium content.

Table 3 Test Factors and Minimum Cycle Requirements for Wheels in Normal Highway Service — Dynamic Radial Fatigue Test

(*Clauses* 5.2.3, 5.2.4 *and* A-1)

Sl No. (1)	**Wheel Type (Material)** (2)	**'*K*' Front** (3)	**'*K*' Front** (4)	**Minimum No. of Performance Cycles to be Completed** (5)
i)	Ferrous all	2.25	2.0	40 000
ii)	Aluminium all	2.5	2.25	60 000

Table 4 Factors and Minimum Cycle Requirements for Temporary Use Wheels — Dynamic Cornering Fatigue Test

(*Clauses* 5.1.4 *and* A-1)

Sl No. (1)	**Wheel Type (Material)** (2)	**'*S*' Front** (3)	**'*S*' Rear** (4)	**'µ'** (5)	**Minimum No. of Performance Cycles to be Completed** (6)
i)	Ferrous all	1.6	1.45	0.7	9 000
ii)	Cold formed aluminum 5000 series	1.8	1.55		25 000
iii)	Aluminum cast and forged	2.0	1.75		25 000

NOTE — With 3 percent less magnesium content.

Table 5 Factors and Minimum Cycle Requirements for Temporary Use Wheels — Dynamic Radial Fatigue Test

(*Clauses* 5.2.4 *and* A-1)

Sl No. (1)	**Wheel Type (Material)** (2)	**'*K*' Front** (3)	**'*K*' Rear** (4)	**Minimum No. of Performance Cycles to be Completed** (5)
i)	Ferrous all	1.65	1.45	400 000
ii)	Aluminium all	1.80	1.60	600 000

ANNEX B

(*Clause* 6.1.2)

INFORMATION TO BE SUBMITTED FOR TYPE APPROVAL OF WHEEL RIMS

B-1 Following information shall be submitted for type approval of wheel rims :

1 Manufacturer’s Name and Address
2 Telephone No.
3 Fax No.
4 E-mail Address
5 Contact Person
6 Wheel Rim Designation
7 Wheel Rim category (*Disc wheel/Wheel with demountable rim*)
8 Wheel Type
8.1 Material with Grade
8.2 Wheel Mounting holes (Nos.)
8.3 Maximum vertical axle (Front/Rear) load capacity (kN)
8.4 Recommended inflation Service Pressure (kPa)
9 Inset/Outset (mm)
10 Dynamic loaded radius (mm)
10.1 Static loaded radius (mm)
11 Tightening torque for studs and nuts
11.1 Size of Nut/Stud
12 Detail of necessary accessories (if applicable)
12.1 Suitable for tubeless tyre mounting
13 Drawings, in triplicate, sufficiently detailed to permit identification of the type. They shall also show the position in tended for the approval mark and for the wheel markings

ANNEX C

(*Clause* 6.1.3)

CRITERIA FOR EXTENSION OF TYPE APPROVAL

C-1 The criteria for extension of type approval shall be as follows:

Sl No. (1)	*Nature of Change* (2)	*Available Verification/Tests* (3)
i)	Decrease in rim thickness, mounting hole size and change of material	Cornering fatigue and radial fatigue test shall be conducted
ii)	Change of service pressure of tyre	Radial fatigue test shall be conducted
iii)	Change in part number, colour, aesthetic change	No test is required
iv)	Change in number of holes for mounting	Cornering fatigue test shall be conducted
v)	Change in manufacturing plant location	Cornering fatigue test shall be conducted

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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